CLAIMS:

1. A method for estimating a spreading factor in a receiver of a variable spreading factor CDMA system, comprising:

inputting a received signal into a plurality of matched filters, each matched filter having a unique spreading factor, de-spreading the received signal with a spreading code corresponding to the spreading factor and outputting a plurality of de-spread signals;

calculating a mean power for each of the plurality of output de-spread signals; and

estimating a spreading factor of the received signal based on the calculated mean power.

2. The method according to Claim 1, wherein the step of estimating a spreading factor of the received signal based on the calculated mean power, comprises:

determining a maximum mean power, and

finding the matched filter that corresponds to the maximum mean power; and

outputting the spreading factor of the matched filter that corresponds to the maximum mean power as the estimated spreading factor.

3. A method for estimating a spreading factor in a receiver of a variable spreading factor CDMA system, comprising:

inputting a received signal into a plurality of matched filters, each matched filter having a unique spreading factor and de-spreading the received signal with a spreading code corresponding to the spreading factor, and outputting a plurality of de-spread signals;

calculating an absolute amplitude for each of the plurality of de-spread signals;

calculating a matched filter integrand, $MFAI_X$, for each of the plurality of de-spread signals;

calculating a matched filter difference, MFD_X, for each pair of adjacent matched filters; and

estimating a spreading factor of the received signal based on the matched filter difference, MFD_X.

4. The method according to Claim 3, wherein the step of calculating a matched filter integrand for each of the plurality of matched filters comprises:

integrating the absolute amplitude of the output of each of the plurality of matched filters as a function of time, for the time period equal to an estimation period.

5. The method according to Claim 3, wherein the step of calculating the matched filter difference, MFD_X comprises:

computing

$$MFD_x = |MFAI_x - MFAI_{x+1}| \qquad for\ x \geq 1.$$

6. The method according to Claim 3, wherein the step of estimating a spreading factor of the received signal based on the matched filter difference, MFD_X , comprises:

determining which matched filter difference is the maximum; and

finding the matched filter that corresponds to the maximum matched filter difference; and

outputting the spreading factor of the matched filter that corresponds to the maximum matched filter difference as the estimated spreading factor.

7. A method for determining whether a zero rate transmission has occurred in a wide band code division multiple access communications system, comprising:

calculating a first threshold value;

calculating a likelihood ratio;

comparing the first threshold value to the likelihood ratio; and

determining a non-zero rate transmission has occurred if the likelihood ratio is greater than or equal to the first threshold value, or determining that a zero rate transmission has occurred if the likelihood ratio is less than the first threshold value.

8. The method of claim 7, wherein the step of calculating the first threshold factor comprises:

calculating the ratio of the probability that no data transmission has occurred to the probability that data transmission has occurred.

9. The method of claim 7, wherein the step of calculating the likelihood ratio comprises:

calculating the ratio of the value of the probability density function of a data transmission occurring at the value of r to the value of the probability density function of no data transmission occurring at the value of r.

10. The method of claim 8, wherein the step of calculating the ratio of the probability that no data transmission has occurred to the probability that data transmission has occurred comprises:

setting the probability that no data transmission has occurred to a first fixed value;

setting the probability that data transmission has occurred to a second fixed value; and

calculating the ratio of the first fixed value to the second fixed value as the first threshold factor.

11. The method of claim 8, wherein the step of calculating the ratio of the probability that no data transmission has occurred to the probability that data transmission has occurred comprises:

setting the probability that no data transmission has occurred to a third value determined empirically;

setting the probability that data transmission has occurred to a fourth value determined empirically; and

calculating the ratio of the third fixed value to the fourth fixed value as the first threshold factor.

12. A method for determining whether a zero rate transmission has occurred in a wide band code division multiple access communications system, comprising:

calculating a second threshold value, λ_2;

calculating a first test statistic, $T_1(r)$;

comparing the second threshold value to the first test statistic; and

determining a non-zero rate transmission has occurred if the first test statistic is greater than or equal to the second threshold value, or determining that

a zero rate transmission has occurred if the first test statistic is less than the second threshold value.

13. The method of claim 12, wherein the step of calculating the second threshold factor comprises:

calculating a first threshold factor, λ; and

calculating the second threshold factor, λ_2, according to the following equation:

$$\lambda_2 = \frac{[\ln\lambda - \frac{N}{2}\ln(\frac{\sigma^2{}_o}{\sigma^2{}_s+\sigma^2{}_o})]}{[\frac{\sigma^2{}_s}{2\sigma^2{}_o(\sigma^2{}_s+\sigma^2{}_o)}]}$$

14 The method of claim 12, wherein the step of calculating the first test statistic, $T_1(r)$, comprises:

calculating the first test statistic, $T_1(r)$, according to the following equation:

$$T_1(r) = \sum_{n=0}^{N-1} r^2[n]$$

15. The method of claim 12, wherein the step of calculating the second threshold factor, λ_2, comprises:

determining an interference strength signal I, a signal to interference ratio signal SIR, and a first threshold factor λ; and

calculating the second threshold factor, λ_2, according to the following equation:

$$\lambda_2 = \frac{2I(SIR+1)}{SIR}[\ln\lambda - \frac{N}{2}\ln(\frac{1}{SIR+1})]$$

16. The method of claim 12, wherein the step of wherein the step of calculating the first test statistic, $T_1(r)$, comprises:

equating the first test statistic, $T_1(r)$, to an energy signal E_{XM}, determined from the outputs of a plurality of matched filters of the wide band code division multiple access receiver.

17. A method for determining whether a zero rate transmission has occurred in a wide band code division multiple access communications system, comprising:

calculating a third threshold value, λ_3;

calculating a second test statistic, $T_2(r)$;

comparing the third threshold value to the second test statistic; and

determining a non-zero rate transmission has occurred if the second test statistic is greater than or equal to the third threshold value, or determining that a zero rate transmission has occurred if the second test statistic is less than the third threshold value.

18. The method of claim 17, wherein the step of calculating the third threshold factor comprises:

calculating the third threshold factor, λ_3, according to the following equation:

$$\lambda_3 = Q_{R_v^2}^{-1}(P_{FA})$$

19. The method of claim 17, wherein the step of calculating the second test statistic, $T_2(r)$, comprises:

calculating the second test statistic, $T_2(r)$, according to the following equation:

$$T_2(r) = \sum_{n=0}^{N-1} r^2[n] \Big/ \sigma_0^2$$

20. The method of claim 17, wherein the step of wherein the step of calculating the second test statistic, $T_2(r)$, comprises:

determining an energy signal, E_{XM}, of an output of a plurality of matched filters of the wide band code division multiple access receiver, and an interference strength signal, I; and

calculating the ratio of the energy signal E_{XM} to the interference strength signal I, as the second test statistic, $T_2(r)$.

21. A spreading factor detector, for use in a wideband code division multiple access communications system, comprising:

a de-scrambler, with an input connected to a received baseband signal, and a real signal output, and an imaginary signal output;

a SIR processor, with an input connected to the imaginary signal output, and a plurality of SIR processor outputs;

a plurality of matched filters, each matched filter having an input connected to the real signal output, and a matched filter output;

a non-zero rate spreading factor detector having a plurality of inputs connected to the plurality of matched filter outputs, and a plurality of non-zero rate spreading factor detector outputs; and

a zero rate spreading factor detector having a plurality of inputs connected to the plurality of non-zero rate spreading factor detector outputs and the plurality of SIR processor outputs, and an estimated spreading factor output signal.